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1.	D/OLL		✓
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Congress of the United States
OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, D.C. 20510

JOHN H. GIBBONS
DIRECTOR

Record

LEGISLATIVE LIAISON
84-3690

27 SEPTEMBER 1984

STAT

Central Intelligence Agency Headquarters
Office of Legislative Liason
Washington, DC 20505

Dear STAT

I am enclosing a fragment of text which I would like to include in the unclassified Technical Memorandum on antisatellite weapons which OTA is preparing for the Congress. The text deals with a sensitive topic, but says nothing of substance about it beyond quoting two official sources, one (Congressman Aspin's comment) from a published article and the other (Secretary Perle's comment) from the unclassified transcript of an open hearing which will be published in the near future. I believe that the text should be unclassified, but would appreciate a classification review of it by the CIA. I am enclosing a photocopy of the article containing Aspin's remarks and a verbatim copy, typed by me, of the stenographic transcript of Secretary Perle's testimony. I would appreciate receiving CIA's classification determination as soon as possible.

Sincerely,

Michael B. Callaham

Michael B. Callaham
Senior Analyst
International Security
& Commerce Program

Comm. (202)226-2007
FTS 426-0507
FSTS ID# 01146

3.2.1 Contributions of Satellites to Mission Capabilities (U)

(U) The U.S. government has stated that it employs photographic reconnaissance satellites for collecting imagery required to monitor compliance with certain arms control agreements. Congressman Les Aspin, describing this use, has written[1]: "U.S. surveillance satellites currently provide complete photographic coverage of the U.S.S.R. at frequent intervals. If suspicions are aroused by the regular large-area survey photographs, "close-look" cameras can be ordered to rephotograph the area in question, providing more detailed information. The present generation of high-resolution cameras on U.S. satellites are theoretically capable of making a clear photograph of an object one foot across from an altitude of 100 miles."

(U) Whether such satellites are used by the U.S. for collection of intelligence of military value is rarely discussed in public by official spokesmen. A rare official comment on this subject was provided recently by the Honorable Richard Perle, Assistant Secretary of Defense for International Security Policy, who, testifying on space defense matters in open session before a subcommittee of the Senate Committee on Armed Services on 25 March 1984, said "...We believe that this Soviet antisatellite capability is effective against critical U.S. satellites in relatively low orbit, that in wartime we would have to face the possibility, indeed the likelihood, that critical intelligence assets of the United States would be destroyed by Soviet antisatellite systems." This comment suggests that the U.S. does operate satellites which gather intelligence of military value and which are within range of present Soviet ASAT weapons; however, security restrictions prohibit further discussion of the nature of this intelligence or its utility in enhancing military capabilities.

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[1] (U) In "The Verification of the SALT II Agreement," Scientific American, pp. 38 - 45, February 1979.

Excerpts from
Stenographic Transcript
of
Hearings before the Subcommittee on Strategic & Theater Nuclear Forces
of the
Committee on Armed Services
United States Senate

Testimony on Space Defense Matters in Review of the
FY1985 Defense Authorization Bill

Thursday, March 15, 1984

Statement of
The Honorable Richard Perle,
Assistant Secretary of Defense (International Security Policy)

Mr. Perle: "...We believe that this Soviet antisatellite capability is effective against critical U.S. satellites in relatively low orbit, that in wartime we would have to face the possibility, indeed the likelihood, that critical intelligence assets of the United States would be destroyed by Soviet antisatellite systems.

"...We, the Department of Defense, are simply unable to identify a means by which we would verify a ban on antisatellite weapons. And the more comprehensive the ban, the more difficult verification becomes.

"...and when one gets to other technologies -- laser technologies, for example -- ...verifying research and development becomes all but impossible.

"...Let me say that this is not only the conclusion of this Administration, that the previous Administration worked long and hard on the study of the verifiability of an antisatellite ban, produced a lengthy report -- it must be an inch thick -- looked at 20 or 21 or 22 different possible approaches to ASAT arms control, and came to the conclusion that the ASAT problems were insurmountable.

"I share that view, Senator..."

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The Verification of the SALT II Agreement

The U.S. has at its disposal ample "national technical means" of surveillance to detect any attempt by the U.S.S.R. to gain a significant military advantage by violating a new arms pact

by Les Aspin

The keystone of any international arms-control agreement is the ability of each side to make sure the other side abides by it. Without adequate verification of compliance agreements such as the bilateral strategic-arms pacts between the U.S. and the U.S.S.R. are bound to collapse. As the Senate prepares to debate the ratification of the new treaty emerging from the second round of strategic-arms-limitation talks (SALT II) between the two superpowers, charges that the Russians will seek to evade its provisions are beginning to be heard. The charges raise several fundamental questions of verification: How could the U.S.S.R. go about cheating? How could the U.S. discover such violations? What would the U.S.S.R. stand to gain and what would the U.S. stand to lose if the Russians were to violate the SALT II treaty? Let us examine each of these questions in turn to ascertain just what the real problems of verification are.

The SALT II agreement will apparently consist of two basic parts: a treaty lasting through 1985 and a protocol lasting through 1982. A summary of the various provisions included under these two headings is given in the illustration on the opposite page.

The new SALT treaty will provide in the first instance for a gradual reduction in the total number of strategic offensive-weapons launchers allowed on each side, from 2,400 at the time of ratification to 2,250 by 1982. For the purpose of the treaty strategic launchers are defined in such a way as to include land-based intercontinental ballistic missiles (ICBM's), submarine-launched ballistic missiles (SLBM's) and long-range heavy bombers.

The U.S.S.R. could try to evade the ceiling on the total number of strategic launchers in three ways: by deploying new types of strategic weapons, by deploying more weapons of the existing types or by converting nonstrategic, tactical weapons into strategic ones (for example by increasing their range).

The first of these cheating methods—deploying new types of strategic weapons—is perhaps the least feasible and most easily detectable way in which the U.S.S.R. could violate the SALT II total-launcher ceiling. The introduction of a new strategic weapon involves at least five stages: research, development, testing, production and deployment. At any one of these stages the present ability of the U.S. to detect clandestine activity on the part of the U.S.S.R. ranges from fair to excellent. The key point, however, is that the Russians would have to disguise all five stages, and the odds against their successfully doing so are extremely high.

Consider the ways in which the U.S. is currently able to monitor just one of these stages: the testing of strategic launchers. U.S. line-of-sight radars can identify the distinctive "signature" of reflected microwaves associated with each major type of Russian missile. In addition over-the-horizon radars can penetrate deep into the interior of the U.S.S.R. and recognize the characteristic pattern each type of missile makes when it disturbs the earth's ionosphere. Early-warning satellites, originally designed to detect a Russian ICBM attack, can also serve to monitor missile tests: the infrared sensors on these satellites can identify the rocket-exhaust plume of a missile as it is being test-fired. Finally, the U.S. has a complex array of sensors, including assorted photographic gear, on ships and planes that routinely monitor missile-test impact areas on the periphery of the U.S.S.R. and in the Pacific. The information gathered from these sources can be used to distinguish new types of missiles from old ones.

In short, the "national technical means" of surveillance available to this country for observing Russian missile tests are multiple, redundant and complementary. They enable the U.S. to detect all long-range missiles fired from test sites in the U.S.S.R. They are, in fact, far more reliable than most human intelligence gathering (that is, spying), which may yield second-hand, dated information or even false, planted information.

To repeat, testing is only one of the five steps that must be taken before a new weapon is ready to be introduced to the strategic arena. Other means of detection could uncover a Russian attempt to evade this particular treaty provision either before testing (during the research and development stages) or after testing (during the production and deployment stages).

The second method potentially available to the U.S.S.R. for cheating on the overall strategic-launcher ceiling—deploying additional weapons of existing types—is more difficult to monitor than the first cheating method, but here the detection capabilities of the U.S. are still very good indeed. The national techni-

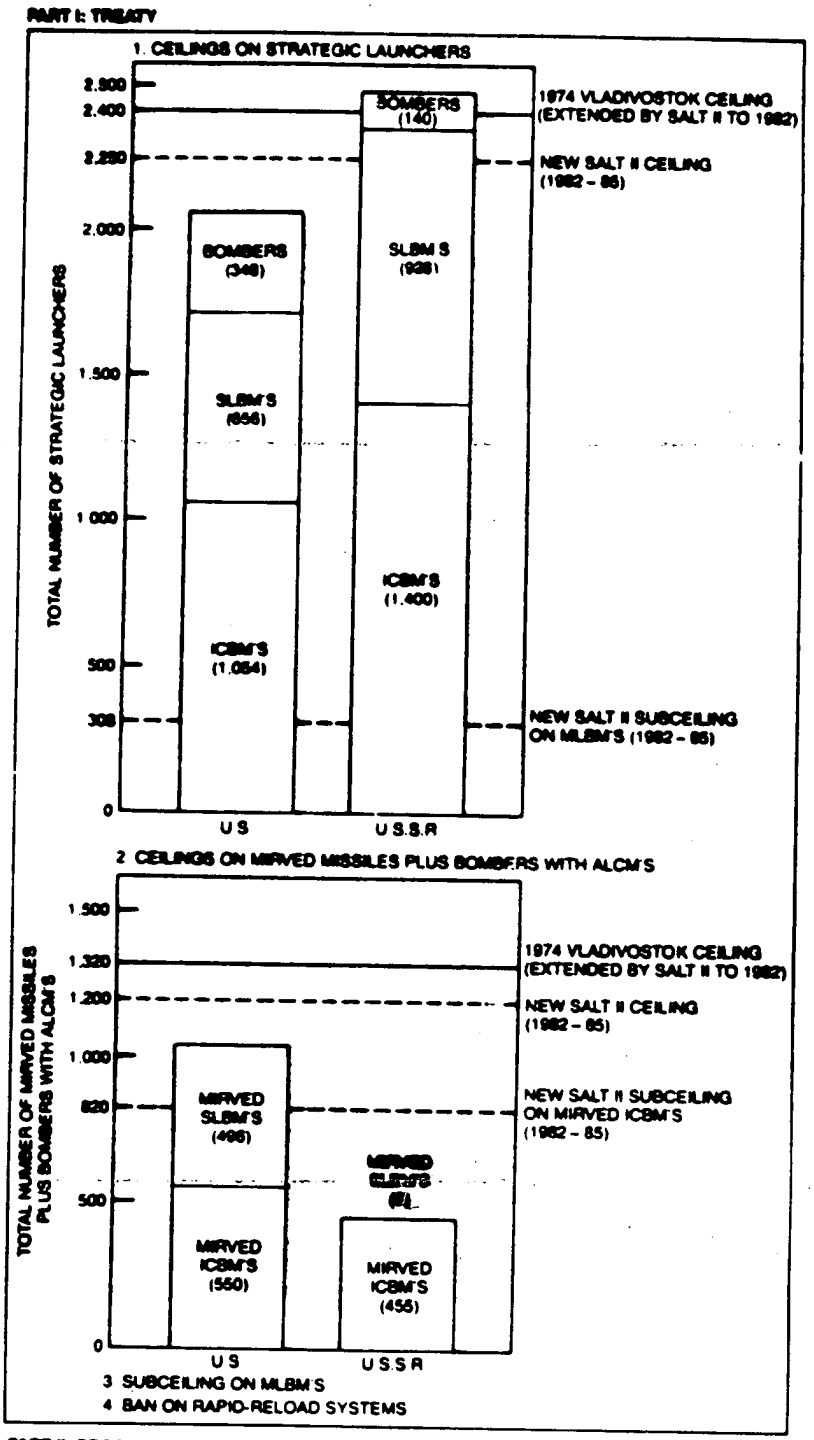
cal means of surveillance adopted by this country are particularly effective in detecting the production and deployment of additional missile-carrying submarines and heavy bombers.

Strategic submarines are large ships, displacing between 8,000 and 9,000 tons and measuring more than the length of a football field. They are hard to hide. Moreover, there are only two shipyards in the U.S.S.R. that currently build submarines of this type. Both these two sites and other potential sites for constructing submarines are constantly watched. Even if a new missile-carrying submarine were to be built under impenetrable cover (assuming the simultaneous successful disguising of all support activities), the new submarine must eventually leave its shipbuilding ways. From that point on there would be innumerable opportunities for observing it. The deployment of additional missiles on Russian submarines also cannot go undetected.

Similarly, the detection of any increase in the number of heavy bombers in the Russian air force is a fairly straightforward task. The production lines for the two existing types of heavy bomber, referred to by U.S. military analysts as the Bear and the Bison, have long been closed. Renewed production of these two aircraft could be detected by the U.S. with a high degree of confidence, as is evident from the demonstrated ability of this country to monitor the production of much smaller pieces of Russian military equipment, such as tanks. The additional deployment of heavy bombers would also be hard to hide. There are no more than 10 heavy-bomber airfields in the U.S.S.R., and all of them are closely watched by U.S. surveillance satellites. If the Russians were to decide to build new airfields equipped to handle such planes, their detection would be easy: runways cannot be hidden underground. If, as some strategic planners expect, the U.S.S.R. were to deploy a new type of heavy bomber by the early 1980's, it too would be readily detectable.

Detecting the deployment of addi-

MAIN PROVISIONS of the SALT II agreement worked out in recent months by negotiators for the U.S. and the U.S.S.R. are contained in two forms: a treaty lasting through 1985 (*Part I*) and a protocol lasting through 1983 (*Part II*). Abbreviations are inserted to in several of the illustrations accompanying this article for the following types of strategic weapons: intercontinental ballistic missiles (ICBM's), sea-launched ballistic missiles (SLBM's), modern large ballistic missiles (MLBM's), multiple independently targetable reentry vehicles (MIRV's) and air-launched cruise missiles (ALCM's). In effect the SALT II treaty subceiling on MLBM's applies to the U.S.S.R. only, since the U.S. has no plans for such large land-based missiles.



tional land-based strategic missiles would be only a little more difficult. Given the current Russian practice in such matters, the U.S. can reliably identify by means of satellite photography such telltale activities in the U.S.S.R. as the construction of new ICBM silos and the transport of missiles to new deployment sites. The emplacement of command-and-control systems and associated support equipment can also be detected.

If the Russians were to attempt to hide these activities, they would probably have somewhat more luck than they would with strategic submarines. After all, land-based ICBM launchers are smaller than submarines, and there are vast interior areas of the U.S.S.R. in which they could be built or based. Even in the case of additional ICBM's, however, the likelihood of successful large-scale deception is very small. The Russians might try to build more ICBM launchers in the open, on the assumption that the vastness of their country would hide the violation, but that would be a mistake. U.S. surveillance satellites currently provide complete photographic coverage of the U.S.S.R. at frequent intervals. If suspicions are aroused by the regular large-area survey photographs, "close look" cameras can be ordered to rephotograph the area in question, providing more detailed information. The present generation of high-resolution cameras on U.S. surveillance satellites are theoretically capable of making a clear photograph of an object one foot across from an altitude of 100 miles. Photographs at this resolution would leave little doubt about the nature of the activities in question.

Alternatively the Russians could attempt to deploy additional ICBM's under camouflage or at night. U.S. satellites, however, are now equipped with multispectral sensors that can penetrate camouflage and can also observe nighttime activity. Infrared sensors are particularly good at detecting underground missile silos and silos that have been camouflaged. As long as the ground in the immediate vicinity of the suspicious object is at a different temperature from that of the surrounding terrain (or has different infrared-emission characteristics) an underground or camouflaged missile silo will stand out in the infrared image.

Primarily because of the time it takes for U.S. photoanalysts to process the data contained in such satellite pictures, small-scale violations might be hard to identify. Any sizable effort to cheat (say a clandestine addition of 100 ICBM's), however, would surely be detected.

The third method of cheating on the overall strategic-launcher ceiling—converting nonstrategic weapons into strategic ones—presents a more challenging problem of verification. Two notable examples of Russian intermediate-range weapons that could be made long-range (and therefore strategic) weapons are the Backfire bomber and the SS-20 intermediate-range ballistic missile (IRBM).

There is little disagreement within the U.S. intelligence community that the primary purpose of the Backfire is to carry out missions in areas peripheral to the U.S.S.R. (such as Europe and China). Roughly half of the Backfires deployed so far have been assigned to naval-aviation missions, and the rest are part of the U.S.S.R.'s medium-bomber force. There is also little question, however, that the Backfire has some intercontinental capability, specifically for one-way missions with recovery in a third country, for round-trip attacks against the western U.S. and, provided the bombers are refueled in flight, for even longer round-trip missions.

Although the SALT II treaty will exclude Backfires from the overall count of strategic launchers, the treaty will be accompanied by a variety of assurances (some in the form of unilateral statements) that will limit the strategic value of the aircraft. These assurances could include limits on the production and deployment of the Backfire, restrictions on the employment of the bomber in conjunction with tanker aircraft capable of in-flight refueling and limits on the bomber's range and payload. Of these assurances the easiest to verify would be the limits on production and deployment (even assuming deception), simply because of the size and complexity of these activities. These constraints are as applicable to the Backfire as they are to the strategic Bear and Bison bombers discussed above.

Verifying tanker restrictions would be a little harder. U.S. Air Force pilots testify to the difficulty of midair refueling. It is extremely doubtful that the Russians would actually try to refuel Backfires during a war without having attempted some practice runs, and practice runs can be monitored by a variety of means, including listening in on aircraft communications. If the Russians wanted to take their chances and attempt wartime refuelings without rehearsals, however, there is no guaranteed means of verifying any such restrictions on tanker employment.

The most difficult of the SALT II Backfire assurances to verify involve the plane's characteristics, specifically its range and payload. Even with unhindered surveillance there has already been some dispute among U.S. analysts over the range of the Backfire. Assuming skillful and determined cheating on the part of the U.S.S.R., both the range and the payload of the Backfire could probably be disguised.

The other intermediate-range weapon that could be converted into a strategic weapon is the SS-20 IRBM. The SS-20 is not covered by the SALT II treaty, since its present range (3,000 kilometers) is less than the 5,500-kilometer lower limit used to define ICBM's. The potential problem stems from the fact that the SS-20 comprises the first two stages of the advanced three-stage SS-16 ICBM; moreover, the mobile launcher for the SS-20 is identical with that for the SS-16. By surreptitiously stockpiling SS-16 third stages and payloads the Russians could at some point in the future be in a position to upgrade SS-20's into SS-16's on short notice. This course of action could provide them with a significant

	STRATEGIC-WEAPONS LAUNCHERS	NUMBER OF LAUNCHERS DEPLOYED	NUMBER OF WARHEADS PER LAUNCHER	TOTAL NUMBER OF WARHEADS
MIRVED	MINUTEMAN III ICBM	550	3	1,650
	POSEIDON C-3 SLBM	496	10	4,960
	SUBTOTAL	1,046		6,610
NOT MIRVED	TITAN II ICBM	54	1	54
	MINUTEMAN II ICBM	450	1	450
	POLARIS A-3 SLBM	160	1 (3 MRV'S)	160
	B-52D BOMBER	79	4	316
	B-52G, B-52H BOMBERS	269	4	1,076 (+1,500 SRAM'S)
	SUBTOTAL	1,012		3,556
TOTAL		2,058		10,166

U.S. STRATEGIC ARSENAL is broken down in this table into two broad categories: weapon launchers that carry multiple independently targetable reentry vehicles and those that do not. The number of nuclear warheads indicated for the Poseidon C-3 SLBM is believed to be an average figure. The number of B-52's available for strategic missions is an estimate. The number of warheads per strategic B-52 listed represents the standard loadings the B-52H and B-52G aircraft carry an additional complement of nuclear-armed short-range attack missiles (SRAM's). The three reentry vehicles on the Polaris A-3 SLBM are not independently targetable and hence are not counted as MIRV's. Cruise missiles and FB-111 bombers are omitted.

numerical increase in their ICBM force with very little warning.

The SALT II agreement, however, will specifically ban the further production, testing and deployment of the SS-16 ICBM and will further require that existing SS-16's be dismantled. Thus if the Russians were to try to augment their ICBM force by adding a third stage and a different payload to the SS-20's, in effect making them SS-16's, they would be doing so without any opportunity for testing the new system. The existing prototype models of the SS-16 have not been tested in almost two years, and the last test was apparently a failure.

In short, the issue of upgraded SS-20's turns out to be another testing issue. To have any confidence in upgraded SS-20's, particularly enough confidence to satisfy traditionally conservative Russian military planners, the U.S.S.R. would have to test some of them, and as was pointed out above surreptitious testing of new strategic missiles by the U.S.S.R. is a practical impossibility.

The problem of preventing the Russians from converting nonstrategic weapons into strategic ones is complicated by one other factor: the existence of between 90 and 100 "reconfigured" heavy bombers in their arsenal. These aircraft have been modified to serve in reconnaissance and antisubmarine-warfare roles, but they still retain their bomb bays. Any further permanent change in the configuration of most of these aircraft could be detected in time. Nevertheless, about a dozen of these planes were originally built in such a way that they could be rapidly converted into heavy bombers at their airfields, making prompt verification of their nonstrategic roles extremely difficult.

	STRATEGIC-WEAPONS LAUNCHERS	NUMBER OF LAUNCHERS DEPLOYED	NUMBER OF WARHEADS PER LAUNCHER	TOTAL NUMBER OF WARHEADS
MIRVED	SS-17 ICBM	100	1 OR 4	~ 2,500
	SS-18 ICBM	170	1 OR 8	
	SS-19 ICBM	320	1 OR 6	
	SUBTOTAL	590		~ 2,500
NOT MIRVED	SS-9 ICBM	130	1	130
	SS-11 ICBM	620	1 (3 MRV'S)	620
	SS-13 ICBM	40	1	40
	SS-16 ICBM	20	1	20
	SS-N-6 SLBM	528	1 (2 MRV'S)	528
	SS-N-8 SLBM	286	1	286
	SS-N-17 SLBM	16	1	16
	SS-N-18 SLBM	96	1	96
	BEAR BOMBER	100	2	200
	BISON BOMBER	40	2	80
	SUBTOTAL	1,876		2,016
	TOTAL	2,466		~ 4,500

RUSSIAN STRATEGIC ARSENAL is estimated in this table on a similar basis. In accordance with the new SALT II "counting rules" the MIRV subtotals shown here include some 136 ICBM's that have not yet been MIRVed and hence still carry single warheads. In addition the intermediate-range bomber referred to by U.S. military analysts as the Backfire is omitted. In general numerical tallies of this kind fail to reflect substantial U.S. advantages over the U.S.S.R. in terms of missile accuracy and reliability. Moreover, such tables do not include the fact that the U.S. has thousands of tactical nuclear weapons capable of reaching targets in the U.S.S.R., whereas the U.S.S.R. has none in a comparable position to reach targets in the U.S.

Besides limits on the number of launchers, the SALT II treaty will contain numerical limits on missiles equipped with multiple independently targetable reentry vehicles (MIRV's) and on bombers equipped with strategic air-launched cruise missiles (ALCM's). According to the treaty, the sum of these two types of systems will not be allowed to exceed 1,320. Furthermore, no more than 1,200 MIRVed missiles will be allowed on each side, and MIRVed ICBM's will be limited to 820.

There are four ways the Russians might try to increase their combined MIRV/ALCM total beyond the treaty limits: by constructing new ICBM silos and SLBM submarines for the additional MIRVed missiles; by substituting MIRVed missiles for unMIRVed ones in existing missile silos or submarines; by deploying MIRVed payloads on unMIRVed missiles in existing silos or submarines, and by placing strategic ALCM's on additional bombers.

The first way the U.S.S.R. might try to evade the MIRV/ALCM ceiling—constructing new silos and submarines for MIRVed missiles—would clearly be unfeasible, since (as was pointed out above) any cheating on the total number of such strategic launchers can be detected by the U.S. with a very high degree of confidence.

The second way the Russians could exceed the MIRV/ALCM ceiling would be by substituting MIRVed missiles for unMIRVed ones in existing silos or submarines. The U.S.S.R. currently has a number of silos and submarines containing unMIRVed missiles. Detecting their surreptitious replacement with MIRVed missiles requires that the U.S. know which Russian missiles are MIRVed and which silos and submarines contain which missiles.

In the SALT II negotiations both sides have agreed that all missiles of a type that has been tested in a MIRVed mode or has been fired from a launcher with a MIRVed warhead would be counted against the MIRV ceiling. The U.S. proposed this counting rule precisely because it facilitates verification. U.S. analysts already know from extensive observation which of today's Russian missiles are "MIRV-capable," and future MIRV-capable ICBM's and SLBM's can be detected at the test stage.

Although the U.S. knows which Russian missiles are MIRVed, another question remains: Is it possible to tell which silos and which submarines contain which missiles? The answer is again provided by the known differences among missile systems. First, Russian silos that contain MIRV-capable missiles are significantly different in appearance from those that contain unMIRVed missiles. Second, MIRVed launchers require different command-and-control systems, support equipment and other facilities, all of which are observable with existing U.S. satellites.

The various types of missile-launching tubes on strategic submarines can also be identified by U.S. surveillance satellites. Any attempt by the Russians to install existing MIRVed SLBM's on submarines with unMIRVed missiles would require the alteration of the launching tubes, the replacement of fire-control systems and other extensive modifications. These would take time; even a routine overhaul of a nuclear submarine takes from 30 to 36 months. Under the circumstances the changes would certainly be detectable.

Another method of evading the MIRVed-missile limits would be to take an unMIRVed missile and replace just its warhead. If the Russians were to deploy MIRVed payloads onto unMIRVed missiles in existing silos or submarines, that would be very hard to detect. Fortunately no such transferable payloads exist now, and the current generation of Russian missiles have design

characteristics that make it virtually impossible to transfer MIRV payloads from the new MIRVed missiles onto the old unMIRVed ones.

A final method of evading the MIRV ceiling would involve placing strategic cruise missiles on additional bombers. The treaty places a ceiling of 1,320 on the total number of MIRVed missiles plus bombers equipped with ALCM's. Could the Russians exceed that ceiling by producing more than the allowed number of ALCMed bombers?

For the foreseeable future the U.S. will be able to tell which Russian bombers are equipped with cruise missiles, since Russian cruise missiles are externally mounted and therefore visible. Internal mountings would present a problem, but so far the Russians have none. Internally mounted cruise missiles would be detected most readily at the time of their introduction, because the aircraft involved would presumably have to be sent to some central facility to be modified, and the U.S. follows the activities at such facilities quite closely.

The verification of the limit on internally mounted cruise missiles will be eased considerably by the adoption in the SALT II accord of a "type" rule, which states simply that if one bomber of a given type carries ALCM's, all bombers of that design would be counted as ALCMed bombers. Counting which bombers have cruise missiles, however, is not the same as verifying which bombers are strategic. Bombers might be fitted with cruise missiles that had short ranges, which would not qualify them as bombers armed with strategic cruise missiles. Bombers might also be fitted with long-range cruise missiles carrying non-nuclear payloads. Hence a separate and far more complicated problem is determining whether cruise missiles on bombers have strategic ranges (in this case more than 600 kilometers) and strategic payloads.

Under normal conditions the U.S. can obtain adequate if rough estimates of these characteristics, but there is no systematic way of verifying the range of deployed cruise missiles. Significant differences would be revealed neither by the missile's exterior nor by its flight test. Unlike ballistic missiles, cruise missiles do not have to be tested at full range or even near it for the military to have confidence in their performance. Like aircraft, they can be flown for a limited time under cruise conditions, and their range can be estimated on the basis of the amount of fuel consumed. As it happens, the U.S. Joint Chiefs of Staff do have good estimates of the range of existing Russian cruise missiles, and the U.S.S.R. does not yet have air-to-surface cruise missiles capable of strategic ranges. Moreover, the Russians are not expected to have many long-range ALCM's for a number of years, and so it is unlikely that they could exceed the numerical restrictions in the SALT II treaty before it expires in 1985.

As for the payloads of cruise missiles, there is no way at present to distinguish a nuclear-armed cruise missile from a non-nuclear one by external observation. Once again, however, the Russians are not expected to have long-range ALCM's with either nuclear or conventional warheads for a number of years, so that violations of this provision before the treaty expires are unlikely.

Assuming that the Russians do perfect strategic ALCM's, the U.S. would still not be at a loss. If the Russians were to begin refitting existing aircraft with new ALCM's, suspicions would be aroused and the U.S. would be aware of the potential for cheating. Even if a new Russian bomber were equipped with ALCM's but the U.S.S.R. falsely asserted it was not strategic and the U.S. was not able to contradict the assertion, it is doubtful that more than about 120 bombers would be available before the expiration date of the treaty.

The SALT II treaty will also contain a sublimit on the number of modern large ballistic missiles (MLBM's) allowed on each side. Any missile larger than the Russians' SS-19 (which has a "throw weight" of about 8,000 pounds) will count as an MLBM; any missile larger than the largest ICBM currently in the Russian inventory (the SS-18, with a throw weight of roughly 16,000 pounds) will be prohibited. The debate over the substitution of SS-19's for SS-11's after the signing of SALT I provides ample evidence of the sophistication of U.S. monitoring techniques. The dispute turned on the question of whether the installation of SS-19's in SS-11 silos violated the SALT I provisions covering the substitution of "heavy" missiles for "light" ones. The consensus following the debate was that the substitution by the Russians did not violate the letter of the SALT I treaty but that it was inconsistent with one of the unilateral statements made at the time by the U.S. The main point here, however, is what the discussion revealed, namely that the U.S. knew precisely how much larger the SS-19 was than the SS-11.

The SALT II treaty will also prohibit "rapid reload" systems. The purpose of this provision is to protect against the possibility that the U.S.S.R. would stockpile extra ICBM's and fit them into existing launchers once a first salvo had been fired. Loading a 50-ton missile into a silo is considerably more complicated than putting a cartridge into a rifle. The elaborate equipment around existing silos necessary for such a system to work, to say nothing of the storage sites for extra missiles, would certainly be detectable with existing satellites. The Russians could scatter the equipment and extra missiles far from the silos and probably avoid detection in that way as long as they did not test the resulting system; they would then, however, not have a rapid-reload capability, and so there would be no violation of this particular provision.

In addition to the treaty lasting until 1985 the SALT II agreement will contain a protocol lasting until 1982, and there will be verification issues in the protocol too. One part of the protocol will ban the deployment and testing of mobile ICBM launchers. The potential for violation of this section lies in the possible deployment of the existing SS-16 ICBM in a mobile mode; no other mobile ICBM is expected before the protocol expires. There is no question of the ability of the U.S. to ascertain that the Russians have deployed a mobile land-based system. Nevertheless, under certain deceptive basing schemes such as the multiple-aim point, or "shell game," options discussed recently (which involve the construction of hundreds or even thousands of shelters, only a fraction of which contain missiles), verifying the actual number of missiles deployed would be very difficult.

The SALT II protocol will also ban the flight testing and deployment of ground- and sea-launched cruise missiles capable of ranges in excess of 600 kilometers. Since the ranges of cruise missiles cannot be determined accurately in the event of conscious deception, such a ban will not be verifiable.

The flight testing of U.S. cruise missiles has only recently begun, however, and these weapons are not scheduled to be deployed in militarily significant numbers until after the SALT II protocol expires. Current Russian cruise missiles are primitive technologically. The U.S. is far more advanced in the development of compact warheads, computer-guidance systems and small turbofan engines, the technologies that are the key to small but long-range cruise missiles. The U.S. Department of Defense has stated that in cruise-missile technology the U.S. is "10 years ahead of the Russians" and that U.S. cruise missiles now under development are "two or three generations" ahead of current Russian weapons.

There are nevertheless some existing Russian sea-launched cruise missiles that exceed the 600-kilometer limit by as much as 250 kilometers. Because of their primitive design, however, they are very large. Since any attempt to begin new deployments is observable, and since the Russians have no capability for deploying new, long-range ground- and sea-launched cruise missiles until after

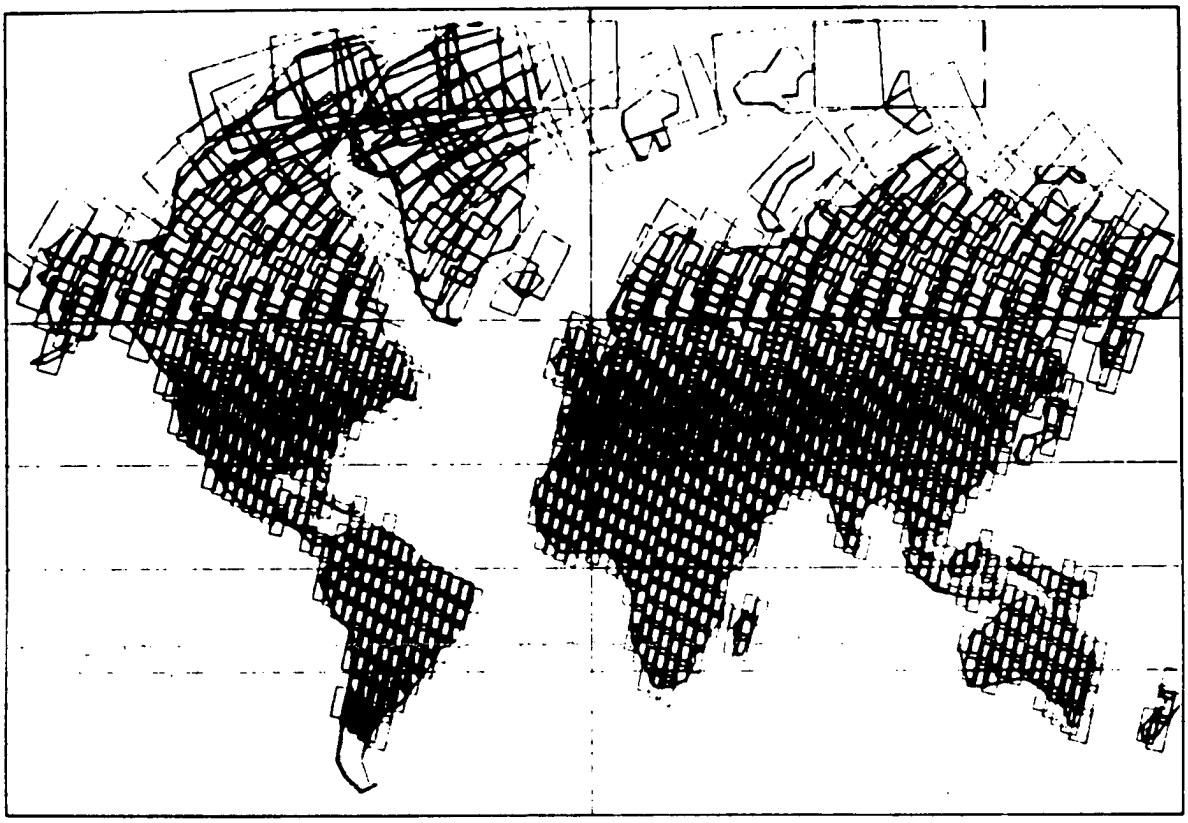
1982, there is virtually no potential here for violations by the U.S.S.R.

The SALT II protocol will include certain limitations on the flight testing and deployment of new types of ballistic missile. Although a full assessment of the associated verification problems depends on a detailed analysis of these limitations, there is reason for optimism. New ballistic missiles can be detected at the test stage, and added deployments of new missiles would be one of the easiest violations to detect.

The ability of the U.S. to detect potential violations of the SALT II agreement by the U.S.S.R. can be summarized in terms of three broad levels of confidence. First, there are the numerous cheating methods for which the verification capabilities of the U.S. are excellent, and the possibility of successful evasion on the part of the U.S.S.R. is remote. These contingencies include all the areas in which major violations by the U.S.S.R. could upset the present strategic "balance of terror": the deployment of new strategic weapons, the addition of even small numbers of bombers and SLBM's, the deployment of additional ICBM's on either a large scale or a moderate scale, the upgrading of the SS-20 missile to the status of a strategic weapon (unless it is upgraded without ever being tested), the deployment of additional MIRVed missiles or ALCMed bombers (in the absence of radically different systems), the upgrading of smaller missiles into modern large missiles and the introduction of rapid-reload systems.

Second, there are several areas in which the verification capabilities of the U.S. are at present quite weak. In all these cases, however, the possible cheating is not militarily significant. The problems of verification include detecting the small-scale deployment of additional ICBM's, monitoring the operational characteristics of the Backfire bomber, verifying that an untested SS-20 upgrade system does not exist and verifying the status of a limited number of heavy-bomber variants.

Third, there are a few areas, mainly those involving cruise missiles and transferable MIRV payloads, in which the U.S. may face serious verification problems at the next stage of the SALT negotiations. Although the Russian cruise missiles of today are primitive, at



WORLDWIDE COVERAGE available with current military photoreconnaissance satellites is suggested by this computer-generated map prepared by researchers at the Itek Corporation's Optical Systems division in connection with their work on the development of a new large-format camera for the National Aeronautics and Space Administration's Space Shuttle project. According to Itek, the new camera is designed "to assist in worldwide exploration for oil and mineral resources, mapping and monitoring of the earth's environment" by providing black-and-white and color imagery "with a coverage, clarity and fidelity that has not been available in the past" from nonmilitary systems. On a typical high-altitude mission, represented here, the Space Shuttle carrying the survey camera would be launched into a roughly circular polar orbit from Vandenberg Air Force Base in California. The rectangular "footprints" outline 3,468 individual photographic frames "exposed during daylight passes in an orbit inclined 97.6 degrees to the Equator and 294 nautical miles high." (The apparent enlargement of the frames at higher latitudes is a distortion arising from the Mercator projection adopted by the mapmakers.) Under suitable conditions the entire globe could be covered by two eight-day Space Shuttle flights, requiring approximately a mile of film contained in two recoverable film loads. On such a mission the photographic ground resolution would average "better than 75 feet (compared with 250 feet for future LANDSAT missions)." The current generation of U.S. military photoreconnaissance satellites are believed to fly in similar polar orbits, although at lower altitudes. In addition to their large-format cameras, such satellites carry "close look" cameras capable in theory of making photographs with a ground resolution of about a foot from an altitude of 100 miles.

some point in the future it will be virtually impossible to determine whether the range of a given Russian cruise missile is long enough to be considered strategic. The U.S. will also not be able to determine whether the payload of a given Russian cruise missile consists of conventional explosives or nuclear explosives. Furthermore, counting cruise missiles accurately will never be easy.

At present the payloads of the MIRVed Russian missiles are so different from their single-warhead payloads that the MIRV's cannot be installed on the old missiles. If the Russians eventually develop a transferable warhead, the U.S. could then face a serious verification problem.

The issues of strategic cruise missiles and transferable payloads are not problems of any great magnitude for the duration of the SALT II agreement. Looking forward to a SALT III pact in the mid-1980's, however, the verification problems are certain to be much more difficult.

In general the surveillance capabilities of the U.S. cited in this article are almost certainly underestimated. The reason is that the assessment considers only those methods of intelligence gathering that can be firmly relied on, such as satellite photography. Actually there is a great deal of other information the U.S. intelligence community receives that cannot be guaranteed in advance. For example, U.S. monitoring of internal communications and signals within the U.S.S.R. might pick up evidence of some activity that is not detectable by satellite photography. An undetected violation might even be revealed by a defector, whose defection could never be assumed in advance. Data obtained under such fortuitous circumstances would undoubtedly reduce even further the chances for successful violations.

The potential for violations is also overstated here because inordinately skillful cheating by the U.S.S.R. has been assumed throughout, a routine assumption in assessing one's own verification capabilities. It may not necessari-

PART I: TREATY

PROVISION	CHEATING METHOD		POTENTIAL FOR UNDETECTED ACTIVITY
1. Ceiling on total number of launchers (2,400–2,250)	Deploying new strategic systems		None
	Deploying more of existing systems	SLBM's	None
		Bombers	None
		ICBM's	[redacted]
	Converting non-strategic systems to strategic systems	Backfire, new production and deployment	None
		Backfire, employing tankers for inflight refueling	[redacted]
		Backfire, upgrading range and payload	
		SS-20, upgrading to SS-16	
		Converting reconfigured bombers	
2. Ceiling on MIRVed ICBM's and SLBM's plus bombers armed with ALCM's (1,320–1,200)	Constructing new missile silos or submarine launching tubes		None
	Substituting MIRVed missiles for unMIRVed ones in existing silos or submarines		None
	Deploying MIRVed payloads on unMIRVed missiles in existing silos or submarines		[redacted]
	Placing ALCM's on strategic bombers		None in near future; minor in early 1980's
3. Ceiling on MLBM's (308)	Upgrading non-MLBM's to MLBM's		None
4. Ban on rapid-reload systems	Deploying rapid-reload systems		None

PART II: PROTOCOL

1. Ban on mobile ICBM's	Deploying mobile ICBM's	None
2. Ban on strategic cruise missiles	Deploying cruise missiles on land-based or sea-based launchers with a range in excess of 600 kilometers	[redacted]
3. Limitations on new types of ballistic missiles	Flight testing and deploying new types of ballistic missiles	Probably none

POTENTIAL VIOLATIONS of the main provisions of the SALT II agreement by the U.S.S.R. fall into three broad categories. First, there are the numerous cheating methods for which the verification capabilities of the U.S. are excellent and the possibility of successful evasion on the part of the U.S.S.R. is remote (*light-color bars*); these contingencies include all the areas in which major violations by the U.S.S.R. could upset the present strategic balance. Second, there are the areas in which the verification capabilities of the U.S. are at present quite weak but in which the possible violations are not militarily significant (*medium-color bars*). Third, there are a few areas in which the U.S. does not face serious verification problems at present but may at the next stage of SALT negotiations (*dark-color bars*).

ly be a realistic assumption, however, because even the best-laid plans of a nation attempting to cheat can go awry.

Take, for example, the one known case in which the U.S.S.R. attempted a significant covert strategic-arms buildup: in Cuba before the missile crisis of October, 1962. Although the Russians clearly wanted to hide the emplacement of offensive missiles in Cuba, they were quite inept at doing so. On several occasions standard operational procedures and routines, which are necessary for the functioning of any large organization and are notoriously inflexible, betrayed their plans. For cheating to be successful everything must work perfectly. In the real world, however, unforeseen events upset plans. To be sure, one cannot count on any particular scheme's going awry, but any nation would be foolish to count on its not happening.

There has already been a heated debate in the U.S. concerning possible Russian violations of the SALT I agreement. That experience has raised a number of questions about the intentions of the Russians regarding their compliance with existing treaties, but it has not raised any questions about the ability of the U.S. to monitor what the Russians are doing. Indeed, the very basis for the allegations that violations have taken place is the detailed information the U.S. intelligence services have gathered on Russian actions since the SALT I pact was signed. The debate has centered not on what the Russians' actions have been but rather on what their actions mean. If the U.S.S.R. had engaged in illegal behavior that had gone unnoticed, this would obviously raise doubts about the detection capabilities of the U.S., but no one has even hinted that this might be the case.

So far only the potential for undetected violations has been considered here. An equally important issue is whether the Russians would attempt to cheat if they felt they could get away with it. The potential for violations is small; the likelihood of violations seems even smaller.

First, the SALT II framework provides enormous leeway for both sides to pursue strategic programs without cheating. Although the Russians would be able to build substantially larger forces without SALT II, they can still do much under the terms of the treaty. They can scrap existing missiles and replace them with more reliable and more accurate models. They can greatly increase their inventories of multiple-warhead missiles. They can direct a greater effort into areas not prohibited by SALT II, such as antisubmarine warfare, that could be perceived in the U.S. as threatening.

Second, even if the Russians became dissatisfied with the SALT II agreement after signing and ratifying it, they still would not necessarily cheat. Several alternatives might seem at least as attractive, if not more so: seeking the renegotiation of certain provisions, seeking to modify the terms of the SALT II pact in the SALT III negotiations, reneging on a part of the treaty (or even withdrawing from the treaty altogether), partly modifying their programs to comply with the treaty and so on.

Third, there is the question of what benefits would accrue to the U.S.S.R. from cheating. There could be no political gain unless the Russians made their transgressions public. No one is intimidated by weapons that are not known to exist. Yet if the Russians did make public the fact of their cheating, there would be enormous political repercussions. The U.S. Government, for example, might find itself pursuing an unprecedented arms buildup in response to the expressed demands of an aroused American public.

The real dangers stemming from Russian violations of SALT II would arise only if there were a significant military advantage to be gained by cheating, for example, if the Russians, after cheating for a few years, could then unveil a devastating superiority that would force the immediate surrender of the U.S. That, however, is impossible. Under the terms of the SALT II agreement the U.S. will still have a formidable strategic arsenal: almost 2,000 launchers and roughly 10,000 independently targetable warheads. To upset the strategic "balance of terror" the Russians would require much larger numbers of weapons than they are now allowed, and it would be impossible for them to acquire enough additional weapons without cheating on such a massive and pervasive scale that it would be detectable with certainty.

It helps to consider a number of plausible "worst cases" in which the U.S.S.R. could actually cheat on certain SALT II provisions and evade detection. The Russians might, for example, add as many as 100 ICBM launchers to their strategic arsenal clandestinely, but that would amount to an increase of less than 5 percent in their launcher force and would yield no discernible advantage. The Russians now have almost 2,500 missiles and bombers. Under the terms of the SALT II pact this total would drop to at most 2,250, a cut of about 250. Hence cheating would be more than outweighed by the reduction in forces required by the treaty.

The Russians might also be able to divert some Backfires to strategic missions in case of war. This substitution would add marginally to their second-strike forces but would correspondingly diminish their antiship capability and undercut their capability against enemies on their borders, which would hardly be a fair trade from their point of view.

The Russians might already have an untested SS-20 upgrade potential. Even if this potential were realized, the resulting SS-16 missiles would be the least accurate and least powerful ICBM's of the current generation. The diversion of SS-20's to intercontinental attack missions would also substantially reduce the threat to Western Europe and to China.

The Russians might convert some of their naval aircraft into long-range bombers. Again, this would marginally increase their strategic retaliatory strength while substantially diminishing the threat to the U.S. Navy.

The Russians might also develop an untested, nonrapid-reload capability. The benefit from having a launcher reloaded (at the optimum) 12 hours after a first firing is questionable; the silo could be destroyed in the interim and by that time the reloaded missile is likely to be no more than a potential "rubble-bouncer" anyway.

In other words, even if the Russians were to cheat in every way that might evade detection, they would add little to their strategic power, and they might actually reduce their military strength in other areas.

To sum up, the ability of the U.S. to verify Russian compliance with the SALT II accord is clearly essential to a successful outcome of the agreement. On close consideration, however, it becomes evident that the much-touted problems of verification are more imagined than real. The multiple and duplicative methods of detection at the disposal of the U.S. are sufficient to reveal any cheating on a scale adequate to threaten this country militarily. Certain small violations of the treaty could be achieved by the Russians without detection, but a handful of additional missiles or bombers would add too little to their arsenal to be militarily significant. In the political realm the Russians would stand to lose more than they would gain by violating the single most important treaty they would have with a foreign power.

It is in the future that verification problems might become critical. Technological advances, particularly those involving cruise missiles and transferable MIRV payloads, will stretch the monitoring capabilities of both sides once the SALT II protocol and treaty expire. Dealing with these systems under a SALT III agreement may well require a substantial lowering of the present standards of confidence for detecting violations. At that point a renewed examination of the entire verification issue will be in order.